IBM Operating System/2™
Information and Planning Guide

IBM

Preface

The purpose of this book is to provide planning information on the IBM Operating System/2 ™1 (OS/2 ™00) for technical coordinators, workstation specialists, programmers, and system administrators. OS/2 is a new generation operating system featuring multitasking, memory management, a Communications Manager, and a Database Manager. OS/2 is delivered in two unique packages, IBM Operating System/2 Standard Edition and IBM Operating System/2 Extended Edition. This book describes how OS/2 can increase productivity and provide a foundation for future requirements.

This book provides information on the OS/2 components and information to plan, design, and configure a system. Also, information is given on how to migrate user applications from the IBM Personal Computer Disk Operating System (DOS) to OS/2.

Note: In this book, "DOS" refers to only the IBM Disk Operating System.

How This Book Is Organized

This book is organized as follows:

Overview   Provides a brief introduction to OS/2 and its components.

IBM Systems Application Architecture
           Discusses OS/2 participation in the applicable parts of the IBM Systems Application Architecture.

IBM Operating System/2
           Discusses the implications of the components, features, applications, interfaces and functions of the system.

Minimum Hardware Requirements
           Discusses hardware, processor, devices, and optional information for planning various system configurations.

Performance Characteristics
           Explains Disk I/O, multitasking, memory space considerations and compatibility considerations.

Programming Considerations
           Discusses the use of existing DOS programs. This portion of the book also discusses new OS/2 functions, Application Program Interface (API), OS/2 environment, family applications display management, I/O privileged level, messages, dynamic linking and development flow.

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Planning Considerations

Provides information on requirements for installing OS/2 and migrating applications to the OS/2 environment. This information is addressed in three parts:

1. Operating System/2 Standard Edition discusses the base IBM operating system and enhancements such as graphics, windowing facility and user shell. This section also discusses compatible hardware, software migration, new applications, training and systems support.

2. Operating System/2 Extended Edition Communications Manager discusses the advantages of standardizing Personal Computer communications, preparation for installation, and the Communications Manager user. This section also explains programming interfaces, customer responsibilities and training aids.

3. Additional Planning Considerations discusses the evaluation of applications and their ability to use the Intel® 80386.

System Installation Considerations

Explains the process of installing the system, setting up the CONFIG.SYS file for start up and use. This section also explains the installation architecture, and new versus old applications.

Planned Enhancements

Describes the enhancements planned for the future.

Packaging and Release

Gives information on component availability.

Appendix A	National Languages Support
Appendix B	Applications Support
Appendix C	Communications Manager Connectivity Support
Appendix D	Hardware Support
Glossary	Describes terminology used in this document.
Index	Provides a comprehensive reference.

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Contents

Overview

The IBM Operating System/2 (OS/2) is a new generation operating system that provides new and expanded function for the application user and the application developer. OS/2 is offered in two versions:

- IBM Operating System/2 Standard Edition; the Standard Edition is a multitasking operating system that breaks the 640Kb memory barrier and runs multiple applications concurrently. A Presentation Manager provides the capability for graphics and windowing functions.

- IBM Operating System/2 Extended Edition: the Extended Edition is a comprehensive operating system which contains a Communications Manager that supports a broad range of communications capabilities and a Database Manager that supports the IBM relational data base model, plus the operating system functions and Presentation Manager provided by the Standard Edition, Version 1.1.

To enable users to take advantage of the new enhanced operating system functions, as early as possible, OS/2 will be released in three editions:

1. OS/2 Standard Edition, Version 1.0, which contains the base IBM operating system.

2. OS/2 Standard Edition, Version 1.1, which enhances the base IBM operating system by adding the Presentation Manager which is a graphics and windowing facility and an enhanced user interface.

3. OS/2 Extended Edition, Version 1.1, which includes OS/2 Standard Edition, Version 1.1 and adds the Communications and Database Managers.

National Language Support provides:

- Support of national keyboards in both the PC and emulation modes of operation.

- Support of code page (character set) switching.

- Enabling for Double Byte Character String (DBCS) support for the Asian languages.

- Remappable keyboards for 3270 and async emulation.

OS/2 is a comprehensive product providing an Operating System, a Communications Manager and a Database Manager, complemented by a set of terms and conditions and a service and warranty plan which are designed to meet the demands of today's business environment.

The new service and warranty plan provided with OS/2 establishes a point of contact either through a dealer or an organizational representative to resolve product problems. Also included with OS/2 are new terms and conditions for OS/2 software available with the Multiple License Agreement. A complete set of publications will be available for all components.

IBM Systems Application Architecture

IBM Systems Application Architecture defines selected software interfaces, conventions and protocols that serve as a common framework for application development, portability and execution across the three major IBM hardware architectures: System/370, System/3X and IBM Personal Computers.

IBM Systems Application Architecture provides a framework for developing and delivering future IBM products, it addresses cross system consistency requirements, and represents the following significant IBM commitments:

1. To enhance the consistency of software products across the IBM System/370, System/3X and the IBM Personal Computers.

2. To define and implement consistent application-enabling interfaces with which customers, independent software vendors and IBM can build consistent application software for the three major hardware architectures.

3. To define and implement protocols, data streams and interfaces that support connectivity of systems and programs and permit sharing of information across all IBM systems.

4. To define and implement standard user interfaces:

   a. Screen layout: How commonly used elements such as titles, instructions, data areas, scrolling information and action items should be presented on the screen.

   b. Interaction Techniques: How menus should be presented and options selected, how data or command entry fields should be displayed, how input should be entered, and how and where prompts and messages should be displayed.

   c. Keyboard Usage: Which functions should be assigned to specific keys, techniques that should be used for option and menu selection (allowing options for a keyboard, program function keys and a mouse or other pointing device).

   d. Display Options: A standard hierarchy of functions will be defined based on the type of display (for example, intelligent, graphics, alphanumeric, fixed function).

IBM Operating System/2 will participate in the IBM Systems Application Architecture. This includes aspects of the user interface, the programming language support, application programming interfaces, communications support and data base support.

The Presentation Manager contains a common programming interface which is designed to make it easy to write applications which conform to the Common User Access (CUA) of the IBM Systems Application Architecture. It is an initial step toward a common programming interface supporting both presentation and dialog interaction.

IBM Operating System/2

IBM Operating System/2 (OS/2) is a substantially enhanced operating environment which provides new and expanded function for both the user and the application developer.

OS/2 combines many computer functions which are normally available separately, such as the operating system, windowing, communications, and data base functions, into one package. This gives the user a lot of power and function at hand. For example, a user might need to use a spreadsheet package which incorporates data from the host and department data bases, and then print the results on the department laser printer. Additionally, this same user may need access to host-based applications (for example, Professional Office System (PROFS™[1]), or note-taking facilities) or external service bureaus (such as, Dow Jones News/Retrieval[4] or Compuserve Information Service[5]) may be required. OS/2 places all these capabilities at the users fingertips as illustrated in the following diagram:

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┌──────────────┐
│ Other        │
│ Applications │
└──────────────┘
       ↕
┌──────────────┐     ┌─────────────┐        ┌──────────┐
│              │     │ Central     │        │ External │
│   PROFS      │ ◄── │ Data Base   │        │ Service  │
│              │ ──► │ 370 Host    │        │ Bureau   │
└──────────────┘     │ System      │        └──────────┘
                     └─────────────┘
        3270                              ASYNC
                  ┌──────────┐
                  │  OS/2    │
                  │  User    │
                  └──────────┘
                     IBM LAN

┌──────────────┐                    ┌────────────────┐
│ Department   │                    │ Department     │
│ Data Base    │                    │ Laser Printer  │
└──────────────┘                    └────────────────┘
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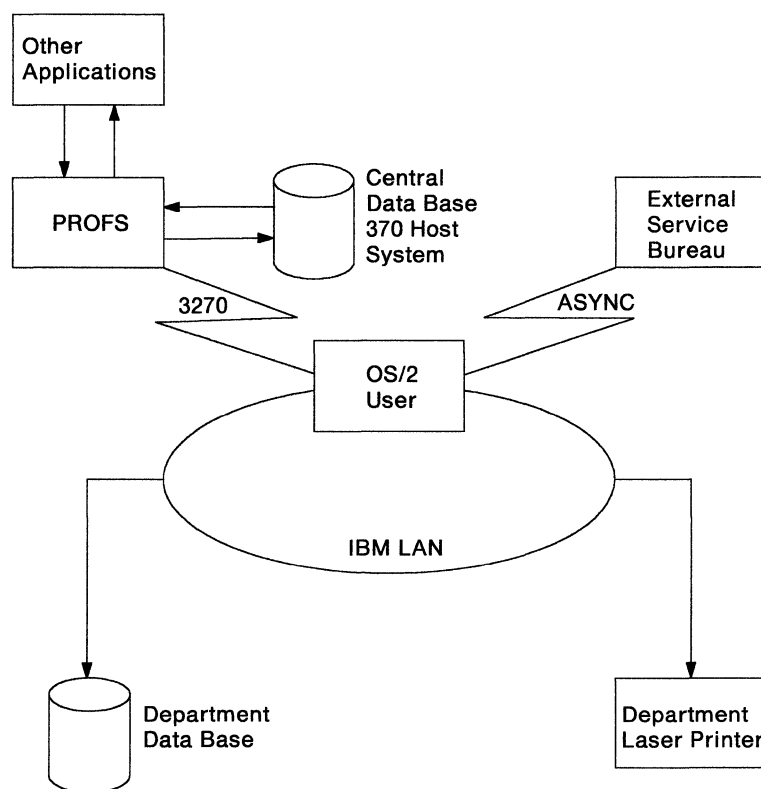
[4] Registered trademark of Dow Jones and Company, Incorporated

[5] Registered trademark of Compuserve Incorporated

Standard Edition

The Standard Edition consists of two versions. Standard Edition, Version 1.0 supports large applications that exceed 640Kb (up to 16Mb, if available), provides the ability to run multiple applications concurrently and supports data sharing among and within applications. Standard Edition, Version 1.1 enhances the base operating system by adding graphics and windowing capability, which is provided by the Presentation Manager.

Compatibility with DOS is provided by OS/2. Many applications that run under DOS will run unchanged in the DOS environment of OS/2. This allows users to run DOS applications in parallel with applications written for the OS/2 environment until the DOS application becomes available for the OS/2 environment. The OS/2 environment will allow the application to take full advantage of the concurrent processing capabilities of OS/2.

Presentation Manager

OS/2 Presentation Manager will be added to Standard Edition, Version 1.0 operating system in Standard Edition, Version 1.1 and contains significant usability enhancements. OS/2 is designed to provide more consistent user interfaces, particularly in the use of the keyboard, the pointing device, screen layouts and terminology. A window manager, supported by enhanced graphics services, provides facilities which simplify user operations when multiple applications are running concurrently. Menus allow selection of program options while viewing the application screen. Comprehensive context sensitive help screens and familiarization programs enable earlier user productivity. Online familiarization programs are available for the Standard Edition and for the Extend Edition Communications and Database Managers.

Interactive character and graphics applications may be developed which use the Presentation Manager programming interface to produce applications that are consistent in appearance and easy to use. Following are functions provided by the Presentation Manager:

Windowing: Windowing allows several applications to be viewed at the same time. Each application can support multiple windows. The user can control window size and position, and can create or delete windows. A clipboard function enables the user or application to extract data.

Graphics: Graphics support enables the development of a broad range of applications that take advantage of the supported all-points-addressable (APA) devices. Presentation Manager contains a wide range of vector graphics and extensive font support, including multiple font styles and sizes. Graphics orders can be stored, to enable the application to manage the picture data and facilitate fast redrawing of pictures.

Enhanced Ease-of-Use Facilities: Enhanced ease-of-use facilities in OS/2 can promote faster learning for the novice and higher productivity for both the novice and the experienced user. OS/2 ease-of-use facilities provide comprehensive help information and descriptive system messages. Much of this help information is contextual in nature, giving the user the information needed to complete the current task. An online *Introduction to OS/2* for the Standard Edition helps the user get started and learn how to perform basic system tasks. There are also familiarization programs for the other components of OS/2.

The menus provided are designed to conform to the IBM Systems Application Architecture conventions for Common User Access and to provide an easy to use and consistent user interface. By way of menu selections, the user can start, stop, add, and delete applications from the system as required. The size and position of the application windows can also be controlled. Local printout on a printer or plotter can be obtained as well.

Memory Addressing

OS/2 uses the native mode of the Intel 80286 (and the Intel 80286 compatibility mode of the Intel 80386) to support up to 16Mb of addressable memory in the IBM Personal System/2™, Models 50, 60 and 80, IBM Personal Computer AT®, and IBM PC XT™, Model 286 systems. By using these modes, OS/2 provides a transparent way for application developers to take advantage of memory beyond 640Kb for applications and data. For example, an application could process a very large spreadsheet and have all of it resident in memory at once. The user would not have to split the spreadsheet into smaller segments and since the spreadsheet is resident, recalculation can be faster.

Multiple combined applications that exceed 640Kb can be resident simultaneously. This feature, in association with multitasking, can lead to significant productivity improvements.

OS/2 supports memory overcommitment; that is, the size of an application's code and data can exceed the physical memory available. This allows more flexibility in how programs and data overlays are processed. However, this should be used with caution since it could have performance implications.

Concurrent Processing of Applications

New applications written to take advantage of the function provided in OS/2 can be run concurrently for the convenience and increased productivity of the user. Applications can coexist within the machine and not interfere with one another. OS/2 takes advantage of the protection mechanisms of the Intel 80286 to provide this facility. Programs written to take advantage of the facilities of OS/2 run in the OS/2 environment. Time previously spent starting and stopping, entering and exiting applications in a single application environment can be spent actually processing data and managing system resources. Multitasking allows many of these applications to be active at any point in time.

Common Programming Interface

OS/2 Version 1.0 provides application developers with a high-level, common programming interface to the operating system. Applications written to this interface should maintain compatibility with successive versions of the operating system. Applications can also take advantage of a high level of device independence to protect the user's investment in application software, but allow for upgrading to new versions of the OS/2.

Application developers can also use a subset of the OS/2 common programming interface to allow OS/2 programs to run under DOS or OS/2. This subset is called the Family Application Interface. Programs written to this interface do not take full advantage of the advanced functions of OS/2.

DOS Compatibility

The DOS environment of OS/2 allows many existing DOS applications to run unchanged under OS/2. There is only one DOS environment session, as opposed to multiple simultaneous OS/2 environment sessions. Only one DOS application, no larger than 512Kb, can run at any one time under OS/2, and the DOS environment is suspended when the user switches to the OS/2 environment. Because of this suspension, some timing dependent programs, such as communications tasks, will not run in the DOS environment. Resource management in a multitasking environment is one of the key features of OS/2. The mechanisms used by many DOS applications to support serial devices have been disabled in the DOS environment to protect the integrity of data which is sent to these devices from multiple application environments and to protect the DOS environment programs from timeout conditions caused by switching to the OS/2 environment.

A utility is being provided for the user to enable/disable the mechanisms used by DOS applications to support these devices. When these mechanisms have been enabled by this utility, it is the user's responsibility to assure that the operating system is not switched out of the DOS environment.

OS/2 expands the same basic command set and interface of DOS, to support the extended capabilities of the OS/2.

Generally, programs written for the OS/2 environment will not run under DOS or the DOS environment of OS/2. Likewise, DOS applications generally will not run in the OS/2 environment. However, by using a subset of the OS/2 Application Programming Interface and the facilities of the IBM Operating System/2 Programmer Toolkit, family applications that run in the DOS environment of OS/2, the OS/2 environment, and DOS can be produced.

Additional Tools

Programmer Toolkit: A separate product, the IBM Operating System/2 Programmer Toolkit, is available to make it easier for programmers to develop applications for the OS/2 environment or to develop family applications. Family applications may run in the OS/2 environment, the DOS environment of OS/2, and DOS.

The OS/2 Programmer Toolkit consists of utility programs, sample programs, and programmer documentation. For Version 1.0, the toolkit contains the tools for creating dynamic link libraries and family applications. For Version 1.1, tools for window development and graphics applications will be added.

Technical Reference: An OS/2 Technical Reference that supplements technical information in the OS/2 Standard Edition and OS/2 Standard Edition Programmer Toolkit publications is available separately. Technical Reference topics include: system architecture, device driver architecture, System Application Program Interface, I/O subsystems, and function call and return definitions.

Extended Edition

Communications Manager

The IBM Operating System/2 (OS/2) Communications Manager provides comprehensive communication capability in a single system. Functions that were previously available only in various communications programs for DOS are now available in a single program with the OS/2 functions of multitasking, expanded memory support, and enhanced usability. This innovative software provides greater flexibility in aligning communications requirements for the growing needs of a business.

The Communications Manager provides timely access to information located in a variety of local and/or remote systems; such as IBM Personal Computers, IBM Personal System/2, IBM System/36, IBM System/370, other data services. This flexibility enables a business to receive, and analyze information and expedites making informed decisions on readily available information from various sources.

The Communications Manager enhances productivity through multiple, concurrent communications connections and emulated terminal types. A user does not have to wait for one type of communication session to complete before loading another. Thus, the Communications Manager user has the ability to do more than one thing at a time.

The Communications Manager also allows flexibility in writing applications to several programming medias. This allows software developers to write programs that reflect users' needs.

The Communications Manager is written for the OS/2 environment and can communicate to other IBM Personal Computers and systems over a wide range of local and remote connectivities, including Synchronous Data Link Control (SDLC), Distributed Function Terminals (DFT) mode to an IBM 3174 or 3274, IBM Token-Ring and PC Network Local Area Networks (LAN), and asynchronous (ASYNC) links. Protocols include LU6.2, 3270 data stream (LU2), and asynchronous communications.

Other Communications Manager functions include keyboard remapping, file transfer, and concurrent emulation support for multiple terminal types. Programming interfaces are available to help migrate existing programs as well as to facilitate programmer productivity in application development, and to allow programs to take advantage of the power of the personal computer.

The Communications Manager provides terminal emulation and file transfer. Both synchronous and asynchronous terminals can be emulated concurrently.

The Communications Manager provides concurrent communications and support for a wide range of connectivity options, protocols and terminal emulation:

- IBM 3270 terminal emulation

- Asynchronous emulation

- Advanced Program-to-Program Communication (APPC)

- Network/System Management support, including alerts, error logging, and problem determination.

- IBM Enhanced Connectivity Facilities (ECF) supporting the PC-to-Host Communications provided via the Server/Requestor Programming Interface (SRPI) over LU2 protocols.

- IBM Local Area Network support, including IBM NETBIOS and IBM Token-Ring IEEE 802.2 interfaces for communication across IBM Local Area Networks.

Terminal Emulation

IBM 3270: The following IBM 3270 terminals can be emulated when using DFT mode to an IBM 3174 or 3274:

- IBM 3178 (Model 2)

- IBM 3278 (Models 2-5)

- IBM 3279 (Models S2A and S2B).

All base data-stream functions are supported as well as the multiple interactive screen, extended attributes, extended data stream (including seven colors and extended highlights), and emulator keyboard remapping.

IBM 3101 and DEC VT100: An IBM Personal System/2 or IBM Personal Computer that is connected to a host that supports an asynchronous link can emulate the IBM 3101 (Model 20) or the DEC VT100[6] terminal. Lines can be switched, nonswitched, or directly connected and are compatible with 1984 CCITT V24/V28 (RS232C) as implemented by IBM. A user can access data services such as Dow Jones News/Retrieval Service[4]; Compuserve Information Service[5]; MCI Mail[7]; or The Source[8].

File Transfer

The Communications Manager supports file transfer capability that allows text or binary files to be moved to or from an IBM host, IBM PC, IBM Personal System/2, or other supported non-IBM hosts. The S/370 Host 3270 PC File Transfer Program (also called IND$FILE) works with both 3270 and asynchronous emulation. XMODEM and PACING protocols operate with asynchronous emulation.

Multiple, Concurrent Connectivity

An IBM Personal Computer or IBM Personal System/2 with the Extended Edition of the OS/2 can be attached to an IBM Personal Computer, IBM Personal System/2, a departmental system, or a System/370 family host. Connections can be local (DFT, PC Network, or Token-Ring) or remote (SDLC or asynchronous), and are under the control of the specific architectures and protocols. Data streams and other protocols that allow the IBM PC to communicate as an emulated terminal or directly through a program-to-program interface are supported.

Concurrent operation is a key to productivity. From a communications standpoint, multiple protocols, terminal emulation, and program-to-program support operate concurrently. Thus, communications can be active while a user is accessing another application, such as a spreadsheet. Communications concurrency is limited only by the capabilities of the adapters, memory size, and processor capacity in the IBM Personal Computer. (See Note 1 of Appendix C "Communications Manager Connectivity Support" for some limitations.) Supported System Network Architecture (SNA) links can be shared by applications, which may use up to five 3270 SNA display and/or multiple LU6.2 sessions.

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6 Registered trademark of Digital Equipment Corporation

7 Registered trademark of MCI Communications Corporation

8 Registered service mark of Source Telecomputing Corporation

Communications and System Management

Communications and System Management (C&SM) support for the IBM System/370 host network includes alerts to the host for SDLC, ASYNC, Token-Ring and PC Network. Both ASYNC and PC Network require an IBM SDLC or Token-Ring link to communicate alerts to the host. The Communications Manager provides alerts for network management, a function for problem determination, and controls for SNA communications services. Applications written to the Communications Manager's programming interfaces can take advantage of the alert sending capability.

Problem Determination

The Communications Manager provides functions for gathering and processing of problem determination data. These functions include tracing of programming interfaces and data units; displaying and printing of error logs from file; Communications Manager system dumping; and displaying of background messages. Communications and System Management functions are also provided such as the issuing of alerts.

Programming Interfaces

Several communication programming interfaces are accessible through the IBM Operating System/2 Extended Edition calls. Migration of programs previously written to the supported DOS interfaces, will require recompilation and revision or rewriting.

Advanced Program-to-Program Communications Interface: The Advanced Program-to-Program Communications (APPC) Interface implements the LU6.2 architecture. This interface is designed to save the programmer from the detail and complexity of communications links. It provides control of the conversation with the remote location, provides control of communications services, and supports both mapped (data stream independent) and basic (data stream dependent) verbs. APPC applications can be written to IBM hosts with MVS-CICS and VSE-CICS, and IBM System/36, IBM System/38, IBM System/88, IBM Personal System/2, IBM Personal Computer, IBM RT/PC, and IBM Series/1 systems. It provides the function of the Advanced Program-to-Program Communication Program available today with DOS, modified to take advantage of the OS/2 calls. Any existing programs written to this interface on DOS must be rewritten. This interface supports the IBM Macro Assembler/2 , IBM Pascal Compiler/2, or IBM C/2 compilers.

Server-Requester Programming Interface: The Server-Requester Programming Interface (SRPI) supports the Enhanced Connectivity Facilities (ECF). It enables the writing of simple, communications independent, requester programs that can call to host server programs with synchronous returns. It is supported over links using the 3270 data-stream protocols.

Host server support is available under MVS/TSO and VM/CMS. The same SRPI function is provided in the IBM PC 3270 Communications Family Programs. Programs written to this interface on DOS using one of the supported high-level language facilities can be recompiled for use on OS/2. Programs written to the DOS SRPI assembler macros must be reassembled. This interface supports the IBM Macro Assembler/2, IBM Pascal Compiler/2 or IBM C/2 compilers.

The program may have to be revised if other DOS facilities are used which are not supported in OS/2. If the program has a dependence on specific return codes, it must be revised.

Asynchronous Communications Device Interface: The Asynchronous Communications Device Interface (ACDI) is provided to allow the writing of applications (such as other asynchronous emulators or file transfer programs) that can exchange data over asynchronous links. This programming interface is designed to achieve a high degree of asynchronous hardware independence which allows applications to exchange data over async links.

Device specific programming modules are required for each support device type and are included in the IBM Operating System/2 Extended Edition. Supported functions include the ability to manipulate the line characteristics and connection control (connect and disconnect) without having to deal with physical device-specific characteristics. This interface supports the IBM Macro Assembler/2, IBM Pascal Compiler/2, or IBM C/2 compilers.

IBM Local Area Network Programming Interfaces: The IBM Local Area Network (LAN) Programming Interfaces provide the IBM NETBIOS and the IBM Token-Ring IEEE 802.2 data link control interfaces for communicating across an IBM LAN. Applications already written to these interfaces for DOS must be revised. This interface supports the IBM Macro Assembler/2, IBM Pascal Compiler/2, or IBM C/2 compilers.

Database Manager

The Database Manager provides a relational data base model similar to IBM Data Base2 (DB2) and IBM Structured Query Language/Data System (SQL/DS).

Within the Database Manager, extensive support includes interactive query and report writing similar to the Query Management Facility (QMF).

The Database Manager, in an IBM Operating System/2 Extended Edition environment, implements the relational data model, consistent with DB2 and SQL/DS on IBM host systems. Data definition, retrieval, update, and control operations are supported by the Structured Query Language (SQL). SQL is a high-level data language available to users interactively and through application programs written in IBM C/2 programming language. End-user facilities are available for data entry, data edit, query and report writing. The user interfaces for data entry and data retrieval operations can be tailored to the end-user's requirements, without the need for programming, using the Query Manager's support for customized panels and menus.

Relational Data Model

The Database Manager supports the relational data base model in which data is externally structured in simple, easy to understand tables. Data is organized in rows (records) and columns (fields). The user defines and accesses data in terms of tables and operations on these tables. This simple data format, along with high level application creation tools, means that the user (and the application program) does not have to understand complex physical data structures and access methods. Implementation of the relational model provides a high degree of independence and ease-of-use characteristics for data base design, creation, and access.

Structured Query Language

The Structured Query Language (SQL) supported by the Database Manager is the personal computer participant of the Database Interface element of the IBM Systems Application Architecture.

SQL is a powerful, high level data definition and manipulation language in which users specify what they want to do, not how to do it. SQL is used for data definition, retrieval, insertion, deletion, and updating. SQL supports arithmetic operations on retrieved values. The query functions support selective retrieval from single or multiple tables and dynamic sorting of the set of resulting rows. Built-in functions include summation, grouping, ordering, and basic statistics (for example, calculating an average of the values in a column). SQL statements can be entered interactively or embedded in an IBM C/2 source application program. A precompiler processes the source program to prepare embedded SQL statements for subsequent application program compilation and execution.

Data Types and Storage

The data types supported by the Database Manager include: integer, floating point, packed decimal, fixed and variable length character strings, date, time and time-stamp.

A table is a logical data structure consisting of rows (records) and columns (fields). The maximum number of columns that can be defined for a table is 255. The maximum length of a table row is 4,005 bytes. Special storage techniques allow a 6-byte field in a table row to reference a character string which has a maximum length of 32,700 bytes. This allows a data base to contain text, program code segments, image graphics, or other data which requires a long field. The maximum table size is only limited by the amount of fixed disk storage available. A data base (and all of its tables) must reside completely on a single logical fixed disk (32Mb maximum) or diskette.

Data Conversion

The Database Manager provides Import/Export utilities to assist in exchanging data with other applications.

These utilities allow the user to convert data from an IBM DOS or an IBM OS/2 file to a relational data base table, and from a relational data base table to an IBM Personal Computer file. Data for import must be a single table, such as a file with rows (records) and named columns (fields). Each row must have the same row description. Each column must contain data of the same data type.

Files Supported

Format	File Source	Version Supported
Delimited ASCII (See Note 1)	IBM Personal Decision Series (See Note 2)	1.0
WKS[9]	Lotus 1-2-3[9]	1.0, 1A
WK1[9]	Lotus 1-2-3	2.0
WRK[9]	Symphony[9]	1.0
WR1[9]	Symphony	1.1

Note:

1. This format is also know as Comma Separated Variables (CSV) and Basic Sequential (Basic PRINT # and WRITE #).

2. Many programs can produce delimited ASCII files (for example, dBase II[10], dBase III[10], dBase III Plus[10], etc.)

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[9] Registered trademarks of Lotus Development Corporation.

[10] Registered trademarks of Ashton-Tate.

Database Manager Utilities

The Database Manager provides the following utility functions to support data base operations':

The IMPORT utility converts OS/2 files in other formats to an existing OS/2 Database Manager table. See "Data Conversion" section.

The EXPORT utility converts an OS/2 Database Manager table to an OS/2 file in another format. See "Data Conversion" section.

The BACKUP utility makes a backup copy of a data base. Each data base should be backed up regularly in case part of it is destroyed. The data base can be restored to a recent state from the backup version. This also includes selected backup for new or changed files.

The RESTORE utility restores a data base to its last backed-up state. In order to use the RESTORE data base utility, the data base must have been previously backed-up with the BACKUP utility.

The UNLOAD TABLE utility makes a backup copy of a single user table. Both the data and the table description are unloaded.

The LOAD TABLE utility restores a user table to its last backed-up state. The utility can only restore a table that was backed-up with the UNLOAD TABLE utility.

The REORG TABLE utility reorganizes a user table that has many modifications. The table is organized in a user-specified order and is stored more efficiently for faster access and improved performance.

The RUNSTATS utility updates statistics about the physical characteristics of a user table or its indexes (for example, number of records, number of blocks, average record length). This information is used by the system to determine the most effective way to access data.

Data Control and Protection

The Database Manager provides data integrity and recovery support to protect data from invalid updates and unrecoverable damage. Tools are provided to help the user recover from damage to data, and to set up a security scheme for controlling unauthorized access to the data base.

The Database Manager provides data base security at the users' option:

1. *NO SECURITY*: No password protection.
2. *SECURITY*: The data base can be secured with a password, which a user must provide in order to access the data base. Once access is authorized, the data base is fully accessible to the user.

Transaction Management

A transaction is a series of operations which may result in multiple updates to a data base. COMMIT and ROLLBACK functions help ensure that a data base is properly updated by an application transaction. When an application terminates normally, a COMMIT statement is automatically issued, which allows the data base updates to become permanent. If an application terminates abnormally, a ROLLBACK is issued, which backs out all tentative updates to the data base.

System/Media Recovery

After a system failure, a restart of the Database Manager automatically backs out all uncommitted data base changes and completes processing of all committed changes. To help a user recover from media (disk/diskette) failure, utility programs are provided. See "Database Manager Utilities".

Concurrency Control

Concurrent, multi-user or application access to a data base is supported by row (record) level locking. Row-level locking ensures that an application maintains control of a data base record until the transaction is completed. This prevents another application from simultaneously changing a record, which could result in a loss of data.

Query Manager

The Query Manager provides interactive user facilities for data base definition, query, update, and report preparation. The Query Manager is similar to the IBM Query Management Facility (QMF) on IBM host systems. It is designed to provide access to the data base for users with little or no data processing experience, and provides tools to develop complete data base entry/retrieval capabilities customized for the end user.

Data Base Definition and Update: Data definition is accomplished by allowing the user to create and delete tables, views, and indexes. Data entry/edit allows data to be inserted, updated, and deleted within rows of a table. A formatted display with field prompts assists the user. The user can scroll forward through rows of a table or request a search for rows according to user-entered search criteria. The user can also enter SQL statements that perform these functions using the Command Interface.

Query

Query enables the user to generate SQL queries to retrieve data from data base tables. Query is accessible from either the Prompted Interface or the Command Interface. Using the Prompted Interface, built-in list capabilities are available for finding and selecting table names and column names within tables.

Report Generation

Report Generation is provided by an extensive subset of the Query Common Programming Interface of the IBM Systems Application Architecture. A report generator allows the user to prepare a customized, formatted report using data generated from a data base query. The report can be displayed or printed. The report format can be saved for later use.

The Report Generator provides an interactive process for defining a report format. The user can select data columns and the placement of data columns. Edit codes allow the user to format a field, for example, with the currency symbol, comma, decimal point and percent sign. Edit codes also support the formatting of dates and time of day.

The user can insert text for a page heading, footer, and column headings. Arithmetic calculations such as subtotals, total, average, minimum/maximum value can be specified for columnar data. Printer options such as printer type, line spacing, number of copies can be specified to control the printed output. At any point in the report definition process, the user can generate the report and display the results.

Panels: Panels allows the user to develop customized display screens for data entry, search, and update. The user can design a panel to match the format of an existing printed panel. The displayed panel becomes the user interface to the data base for data search, input, and output operations. A complete, interactive data base application can be developed around these panels, using menus and procedures. Arithmetic operations can be specified for data entered by the user or for data retrieved from a data base. Once the data has been retrieved, the panels can be printed. A single panel can retrieve data from or update multiple tables. Panels can be saved and used with a menu, procedure, or another panel.

Menus: Menus allows the user to define a menu in an application. A menu is used to request predefined data base operations (such as predefined queries, procedures, panels, or another menu) by selecting an option from the menu.

Procedures: Procedures allows a user to store a sequence of statements that can be invoked by a single command. A procedure can be used to develop a simple data base application, and can be invoked from a menu, panel, another procedure, or directly from the operating system. Procedures can invoke a query, menu, panel, report, or another procedure. Procedures can include statements which control the execution flow based on tested variables.

Query Manager User Interfaces

The Query Manager provides a Prompted Interface as well as Command Interface to enhance usability. Users can select the appropriate interface based on their needs and experience.

Prompted Interface: The prompted interface is a menu-driven, windowing interface provided that helps novice and occasional users to interactively construct and execute SQL commands to define tables, enter data, perform data base queries and generate reports. This interface does not require a knowledge of the SQL syntax, however, the user is expected to understand the basic concepts of relational tables and their use. Windows with associated online help information lead the user through the process of selecting tables and fields, and performing the desired data base operations. This interface displays windows to prompt the user for the following actions:

- Query a data base table

- Generate a report based on the results of a current query

- Add, delete, and modify data

- Create and delete tables, views, and indexes

- Create customized panels and menus

- Invoke utility programs

Command Interface: The command interface lets the user enter SQL statements or commands for immediate execution. SQL statements permit table creation and deletion, data base query, data insert, update, and delete. The results of a query can be displayed or printed as a report. Commands can also be entered to execute a sequence of commands (procedure) or a previously defined application, such as a customized report. These commands are consistent with the query/report writing products that participate in the IBM Systems Application Architecture.

Minimum Hardware Requirements

The minimum hardware requirements for running IBM Operating System/2 (OS/2) are shown in the following tables.

Standard Edition without DOS Environment

	PC XT Model 286	Personal Computer AT	PS/2 Model 50	PS/2 Model 60	PS/2 Model 80
Processor	80286	80286	80286	80286	80386
Memory	1.5Mb	1.5Mb	1.5Mb	1.5Mb	2.0Mb
Fixed Disk	20Mb	20Mb	20Mb	44Mb	44Mb

Standard Edition with DOS Environment

	PC XT Model 286	Personal Computer AT	PS/2 Model 50	PS/2 Model 60	PS/2 Model 80
Processor	80286	80286	80286	80286	80386
Memory	2.0Mb	2.0Mb	2.0Mb	2.0Mb	2.0Mb
Fixed Disk	20Mb	20Mb	20Mb	44Mb	44Mb

Extended Edition without DOS Environment

	PC XT Model 286	Personal Computer AT	PS/2 Model 50	PS/2 Model 60	PS/2 Model 80
Processor	80286	80286	80286	80286	80386
Memory	3.0Mb	3.0Mb	3.0Mb	3.0Mb	3.0Mb
Fixed Disk	20Mb	20Mb	20Mb	44Mb	44Mb

Processor

The processor required for OS/2 is either the Intel 80286 or Intel 80386 processor. OS/2 uses the features of the 80286 (and 80386 in 80286 emulation mode) to provide protection and multitasking support.

OS/2 will not run on the IBM Personal Computer, PC XT, Portable PC, Convertible PC, PCjr or the Personal System/2, Model 30.

OS/2 will run on the PC XT, Model 286, IBM Personal Computer AT and IBM Personal System/2, Models 50, 60, and 80.
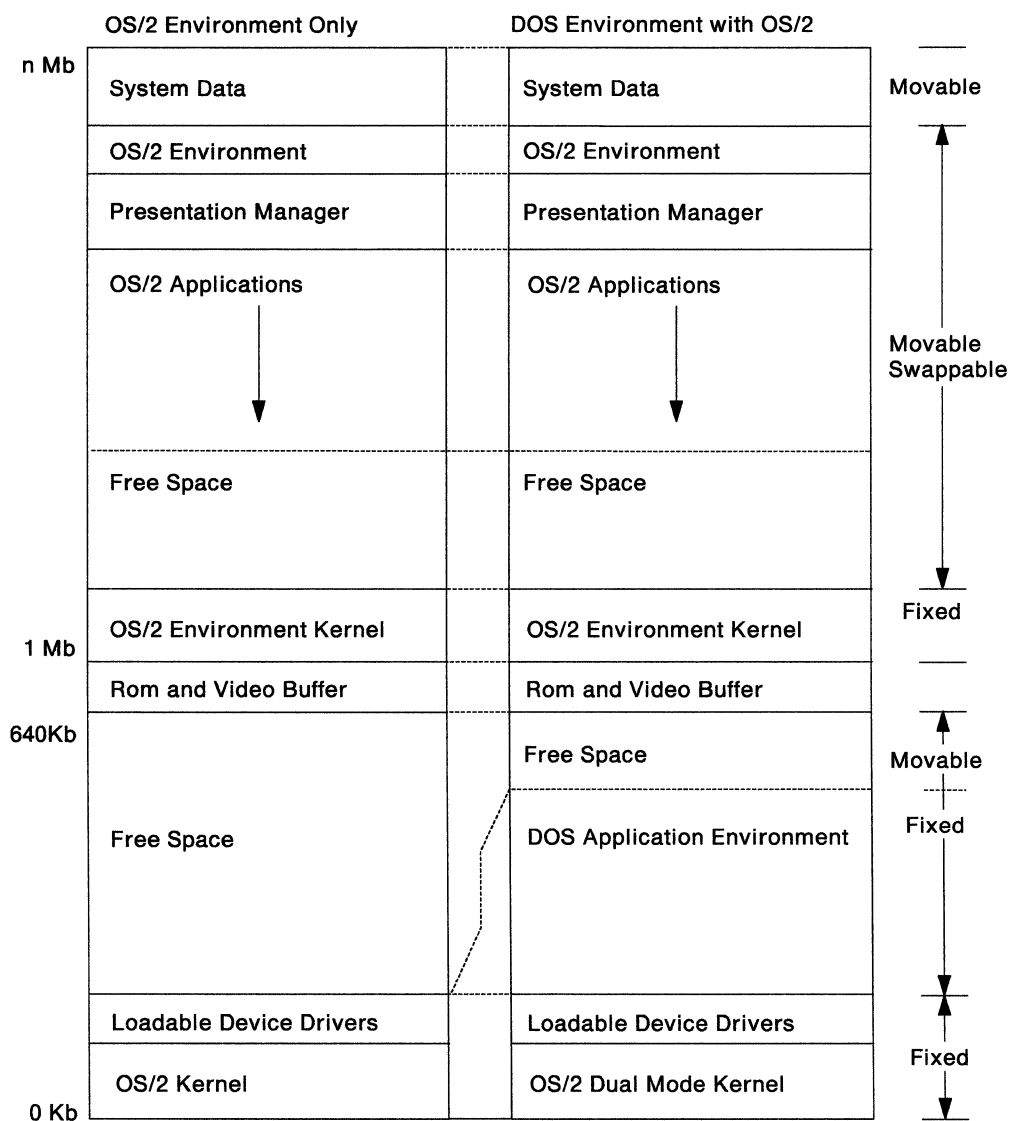
Fixed Disk

A fixed disk is required for OS/2. If the fixed disk is greater than 32Mb, it must be partitioned into two or more logical drives each with up to a maximum size of 32Mb. These are addressed by OS/2 with different drive letters. The system installation diskette can help with this task.

Memory

An IBM Personal Computer AT configured with no memory installed between 512Kb and 640Kb (if 512Kb storage in the base system and one or more 512Kb storage expansion cards installed) is supported by OS/2. However, this restricts the size of the DOS environment to 512Kb.

The following figure shows the memory map for the IBM Operating System/2 Standard Edition.

	OS/2 Environment Only		DOS Environment with OS/2	
n Mb	System Data		System Data	Movable
	OS/2 Environment		OS/2 Environment	
	Presentation Manager		Presentation Manager	
	OS/2 Applications		OS/2 Applications	Movable Swappable
	Free Space		Free Space	
1 Mb	OS/2 Environment Kernel		OS/2 Environment Kernel	Fixed
	Rom and Video Buffer		Rom and Video Buffer	
640Kb			Free Space	Movable
	Free Space		DOS Application Environment	Fixed
	Loadable Device Drivers		Loadable Device Drivers	
0 Kb	OS/2 Kernel		OS/2 Dual Mode Kernel	Fixed

Performance Characteristics

Memory

IBM Operating System/2 (OS/2) allows programs to use a large address space. There are many parallels which can be drawn with the way that memory management works in larger systems, such as IBM 370 architecture machines.

It should be noted that there are significant differences which mean that memory overcommitment cannot be treated in the same way for the OS/2 as in large systems. In large systems, memory overcommitment is the most important and widely used way of managing memory. This is not the case in the OS/2.

Storage fragmentation can occur with OS/2. OS/2 compacts used segments in order to release sufficient free contiguous space. If this has to be done frequently, performance can be impacted.

The basic unit of memory management in OS/2 is the segment and a segment can be up to 64K bytes in length. OS/2 uses a Least Recently Used (LRU) algorithm to calculate which segment should be swapped out when it has to find more space in memory. However, it may need to move out up to 64Kb of data at a time. Again, this can have an impact on performance.

The speed of a typical personal system disk does not lend itself to being used as a swapping device. More specific information on disk speeds is discussed in the "Disk Devices" section following.

It is not recommended that memory be overcommitted during normal usage of applications. Rather, sufficient memory should be installed so that swapping does not occur within an application or when the user is switching among frequently used programs. Memory swapping will probably be acceptable within an application accessing infrequently used code, such as error routines or when the user changes from one set of applications that have been used for a period of time to another set of applications that will be used for a period of time.

Buffers

The BUFFERS parameter in the CONFIG.SYS file specifies the number of 512-byte buffers allocated to disk I/O. OS/2 uses the BUFFERS parameter for single sector I/O only. System performance can be significantly affected by the value of the BUFFERS parameter. A default value of 10 is supplied. This value should be reasonable for a small application system without a large amount of multitasking. For systems which are more sophisticated (more sessions, more multitasking, use of shared disks on Local Area Network or virtual disks on IBM System/3X) a larger value may be appropriate (for example, BUFFERS=50).

Disk Cache

The Disk Cache facility is supported on the IBM Personal System/2 machines. It is enabled by means of the DISKCACHE parameter in the CONFIG.SYS. file. The format is DISKCACHE=N, where N is the number of kilobytes (between 64 and 7200) to be allocated for the cache. Memory is allocated for the cache from real storage above the 1Mb line. Disk Cache works best when the majority of programs and data are contained within the cache. Typically, a 256Kb cache is reasonable. However, experimenting to find the best value suited for a particular environment is advised.

Disk Devices

Disk devices have differing performance characteristics. The major factors affecting the performance of devices are access time, interleave ratio, and transfer rate.

Access time is the average amount of time required for the read/write head to move to the required cylinder.

Interleave ratio defines how the disk controller is constrained in the way sectors can be read. For example, if the interleave ratio is 1:3 then the controller can only read one sector for every three the read/write head passes over. Therefore, if there are nine sectors per track, a 1:3 ratio will mean that 3 revolutions will be required to read the whole track (that is, first sweep reads 1, 4, 7; second reads 2, 5, 8; third reads 3, 6, 9). If the ratio is 1:1 then contiguous sectors can be read and only one revolution would be required to read one track. This can have a significant impact on disk performance.

Transfer rate is the rate at which data is exchanged between the disk controller and main storage. The following figure summarizes the characteristics of the various devices.

	PC XT Model 286	Personal Computer AT	PS/2 Model 50	PS/2 Model 60	PS/2 Model 80
Average Access Time	85Ms	40Ms	80Ms	40Ms	40Ms
Interleave Ratio	1:6	I:3	1:1	1:1	1:1
Transfer Rate (Mbits/Second)	5	5	5	5	10

On a system with two or more disk devices, only one disk can be accessed at a time.

Disk I/O can be affected by changing some of the OS/2 parameters in the CONFIG.SYS file in the root directory of the drive containing the operating system.

Multitasking

OS/2 can execute many tasks concurrently, enabling multiple applications to run simultaneously. Multitasking increases productivity by reducing the time required to switch between applications and by allowing processing to take place in the background while some other task is executing in the foreground (for example, recalculation of a large spreadsheet while doing word processing).

An application may consist of multiple processes. A process includes at least one thread but may consist of many threads. A process owns all resources that are defined by or associated with the executing program. A THREAD is a unit of execution within a process. It inherits resources from its parent process.

Multitasking increases the system resource required to support multiple processes. From a programmer's perspective, care should be taken when using multitasking. When a task switch occurs, the processor must store the context of the task being interrupted and restore the context of the task to which it is passing control. This is a complex process, which is assisted by special functions in the 80286 processor hardware.

The more tasks there are in the system, the greater the system burden will be. Consequently, balancing should be done for the number of tasks between the productivity gain seen by the user and the resource demands of multitasking as seen by the system.

When writing applications, it is generally better to use only as many processes and threads as are necessary, and to use the standard subroutine mechanism for structure rather than multitasking. Using multiple processes and threads permits several functions within an application to run simultaneously. Using processes and threads randomly would cause excessive system burden and is not recommended.

DOS Environment

OS/2 provides the DOS environment as a migration facility for DOS users.

DOS environment applications run in the Intel 80286 real mode whereas OS/2 environment applications run in the Intel 80286 protect mode. This ensures the highest level of DOS compatibility. When DOS applications run in the DOS environment of OS/2, OS/2 has to change frequently between the two environments. Switching from real mode to protect mode is as simple as loading a register, but switching from protect mode to real mode requires a complete reset of the Intel 80286 processor. Resetting is a time-consuming process. Consequently, an application running in the DOS environment will notice some degradation even when no other task is active in the system. Further, when there are application running in both the DOS and OS/2 environments, frequent mode switches will occur, causing some degradation to both environments.

When a switch is made from DOS environment to OS/2 environment, the DOS environment application session is suspended. It does not continue to operate in the background as OS/2 application sessions would. Consequently, timing-dependent applications (for example, communications programs) are not supported in the DOS environment.

Resource management in a multitasking environment is one of the key features of OS/2. The mechanisms used by many DOS applications to support serial devices have been disabled in the DOS environment to protect the integrity of data which is sent to these devices from multiple application environments and to protect the DOS environment programs from time-out conditions caused by switching to the OS/2 environment.

A utility is being provided for the user to enable/disable the mechanisms used by DOS applications to support these devices. When these mechanisms have been enabled by this utility, it is the user's responsibility to assure that the operating system is not switched out of the DOS environment.

Programming Considerations

DOS Programs

DOS programs cannot be run in the IBM Operating System/2 (OS/2) environment: DOS uses interrupts and OS/2 does not. Programs that use the ROM BIOS interface do not run under the OS/2 environment.

DOS programs are .COM files that contain only a code segment. OS/2 does not allow writing to a code segment, which prevents most .COM files from running. OS/2 does not include an EXE2BIN utility to create .COM files.

Programming Languages

The following programming languages can be used to write programs that generate executable code in the OS/2 environment, as well as, the DOS environment of OS/2, and DOS.

> IBM COBOL/2
> IBM FORTRAN/2
> IBM C/2
> IBM Macro Assembler/2
> IBM Pascal Compiler/2
> IBM BASIC Compiler/2

Implications of New OS/2 Functions

OS/2 supports overcommitment of storage; that is, code and/or data can be larger than the physical memory available. See "Performance Characteristics" section for implications of storage overcommitment.

The multitasking capability of OS/2 gives a program the ability to start a thread running concurrently with the parent program. The data segments will be shared by the parent and the child task. An example of using a thread could be a file update routine waiting for data from the parent program, and then performing the update asynchronously with the parent program. A different process from the application can be started, making the two processes totally separated.

The dynamic linking facility makes code sharing easier, so general routines (like floating point subroutines) could be made reentrant. Only one copy would need to be loaded at run time and could be used by multiple processes, thus, keeping storage requirements to a minimum. Seldom used routines (error routines for example) could be loaded only when needed. The memory allocation functions of the OS/2 will help in making programs reentrant.

Application Program Interface

The new OS/2 Application Program Interface is a CALL (FAR) interface. Every function is represented by an external entry point. The dynamic link feature is used to resolve entry point references.

Parameters are passed to OS/2 by pushing them on the stack. This facilitates easier access using high-level languages. For example the CALL conventions in Application Programming Interface match those in the IBM C compiler. Most DOS function calls are mapped to OS/2 function calls, and several new calls are provided.

System Memory

A key feature of OS/2 is removal of the memory restrictions of DOS. Now a program can address 16Mb real memory. Function calls are provided to allocate and deallocate memory segments.

Multitasking

The OS/2 Application Programming Interface provides a set of function calls to support multitasking. These allow a process to create a new thread, or to run another program as a child process. Multiple sessions can be started, selected, or stopped.

Interprocess Communication

The OS/2 enables processes to communicate with each other by several means; shared data segments, pipes, queues, flags, and semaphores.

Shared Data Segments: The simplest way is by means of shared data segments. Functions are provided by the operating system to allocate shareable segments between processes.

Pipes and Queues: A more formal way of communicating is through the use of pipes. The pipe function is similar to that in DOS. It is now available within programs. A DOSMAKEPIPE function call is used to create the pipe, then normal file I/O functions are used. A pipe is maintained in main memory with a maximum of 64Kb of data at any time.

The most sophisticated mechanism provided for interprocess communication is a queue. A queue is manipulated by specific calls to the operating system. It may be ordered by priority or by arrival order First in First Out (FIFO) or Last in First Out (LIFO). Function calls to create, open and close queues are provided in addition to function calls for doing the actual queue manipulation. This differs from pipe manipulation where normal file I/O operations (such as, DOSREAD or DOSWRITE) are used.

A queue has a performance benefit compared to the pipe, because queue data is kept in shared segments, and no data is copied between processes, the way it happens with pipes.

Both pipes and queues support multiple writers but only one receiver. Server functions would typically be implemented by using pipes or queues.

Flags and Semaphores: The OS/2 supports synchronization between processes (or THREADS) via the flag and semaphore mechanisms.

A flag may be set by one process by issuing a DOSFLAGPROCESS call. The other process issues a DOSSETSIGHANDLER to set an entry point to gain control when a flag is raised. The flag mechanism is also used to notify a program if a control-break or control-C is issued by the operator or if a program is terminated by a DOSKILL function call.

Two types of semaphores are provided, the Random Access Memory (RAM) semaphore and the system semaphore. The RAM semaphore is a high speed option with no operating system resource management involved. If the process abnormally terminates, the system does not clean up the semaphores. The system semaphore is managed by the operating system. The actual semaphore function calls are the same for the two types. Semaphores would typically be used to serialize access to resources. They are also useful in providing synchronization between two or more threads (or processes).

Timer Functions

In addition to the familiar GET DATE and GET TIME functions, the OS/2 provides three more time functions.

Function	Task
Timer Function	Task being notified that a period of time has elapsed.
Interval Control Function	Task being notified each time a certain period of time has elapsed.
Sleep Function	Task delaying its execution for a certain period of time.

Device Monitors

A new concept introduced by OS/2 is the Device Monitor function. This function allows an application to intercept data handled by a (character) device driver. The application may modify, delete or insert characters passed to the device drivers, and of course it can inspect the data and take specific action when a certain string of data is encountered.

Screen Interface

In its first release, IBM Operating System/2 Standard Edition, Version 1.0, supports text mode only as provided by the Virtual Input Output (VIO) function calls. The IBM Operating System/2 Graphics Development Toolkit (GDT, a separate product) will be available with IBM Operating System/2 Standard Edition Version 1.0, and enables the developer to use screen graphics by means of the Virtual Device Interface (VDI).

In IBM Operating System/2 Standard Edition, Version 1.1, Presentation Manager will be available as an integral part of the operating system. The Presentation Manager provides APA graphics and text in a windowing environment. A graphics application interface is provided in the Presentation Manager as well as additional VIO calls supporting alphanumeric mode. Applications using the VIO functions will run under the Presentation Manager. Programs using GDT cannot use the Presentation Manager windowing capabilities, however, they will continue to run in full screen mode.

Messages

OS/2 provides facilities that keep messages separate from the application data. In fact, all the OS/2 messages are kept in message files with a numbering scheme for retrieval. It is recommended that a .TXT file be created (with a normal editor) that contains all the messages for individual applications.

OS/2 provides two utilities to handle message files; MKMSGF to create the actual indexed message file (with extension .MSG) from the supplied .TXT file, and a utility MSGBIND that will link your indexed message file to the .EXE file. If the messages are rarely referred to, it is not necessary to link them in the .EXE file, because OS/2 message handler function will look for the message file on disk if not found in the program itself. The name (and path) of the message file must be provided by the program.

Dynamic Linking

The dynamic linking facility allows you to wait until load or run time before resolving external references. A module linked at load/run time is called a dynamic link module. For the linker to create a dynamic link module, it will need information in addition to the .OBJ files (such as whether to resolve references at load time or at run time). The additional information is provided by means of an ASCII text file called the Module Definition File (MDF).

The module calling the dynamic link module also needs information contained in the MDF. A special utility called IMPLIB takes the MDF as input and creates a library module to be input when linking the calling program. This library module does not contain the executable code, but does contain information about the executable code (such as name of the module and entry points within the module). The dynamic link module may be maintained separately from the programs calling it, provided the interface is constant.

Family Applications

The Family Application Programming Interface is a subset of the OS/2 Application Programming Interface that does not exploit the unique features of OS/2. The IBM Operating System/2 Standard Edition Programmer Toolkit provides means to create programs that run in the OS/2 environment, in the DOS environment and under DOS.

When writing a family application, use only the function available in the Family Application Programming Interface and the Intel 8088 instruction set. Memory usage must be confined within the DOS 640Kb limit and abide by a set of other programming rules.

Once the program is compiled, it is linked and the program becomes an OS/2 .EXE module. The OS/2 BIND utility is used to make it a family application. This utility will modify the OS/2 .EXE module with the Family Application Programming Interface library, so that one function call in the program will be served by the appropriate code relative to the operating system in control.

Application Development Flow

The following figure shows the necessary steps to perform in order to create an OS/2 or family application using dynamic link facilities and the OS/2 message functions.
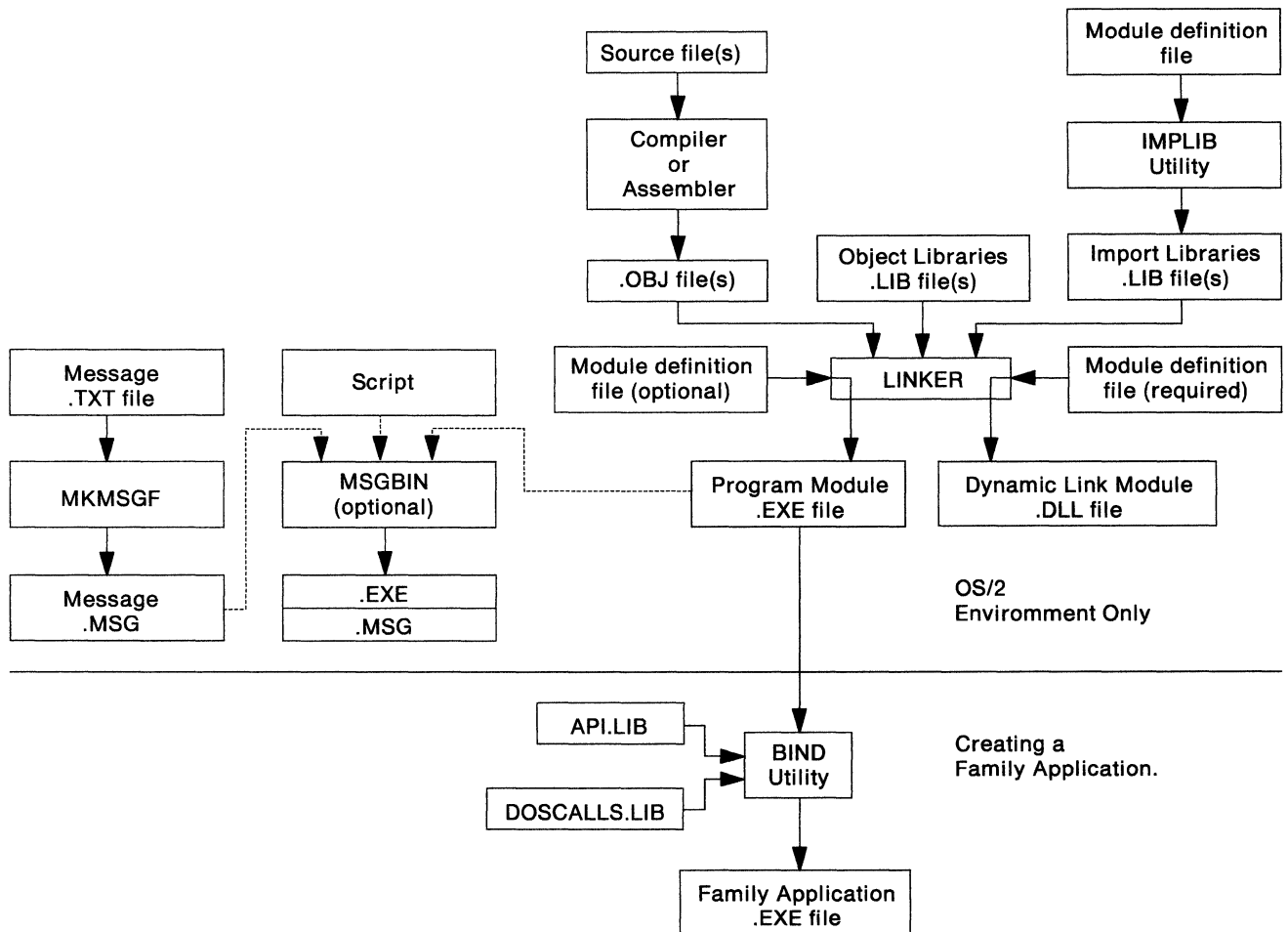
Planning Considerations

Migration to IBM Operating System/2

An organization planning to install IBM Operating System/2 (OS/2) should consider the following:

- How to migrate users to OS/2;
- How to support these users once they have OS/2 installed.

Hardware

OS/2 supports the IBM Personal System/2 family of personal computers, the IBM Personal Computer AT, and the PC XT Model 286, which use the Intel 80286 and 80386 processors. The IBM Personal System/2 family of personal computers takes fullest advantage of the OS/2 functions and is therefore the recommended range of systems to run the OS/2, except Model 30.

Existing IBM Personal Computer AT and PC XT, Model 286 systems may require memory upgrades to run the OS/2 effectively. This may involve displacing existing Intel 8088 based machines which could, for example, be moved to users not requiring the OS/2 function.

Application Requirements

OS/2 is designed for applications that require:

- Sophisticated personal computing, communications and/or data base capabilities.
- Large real memory (above 640Kb).
- Application programs written for the OS/2 environment.

OS/2 is primarily for users who require Intelligent Workstation functions. That is, the user who requires a broad range of function; such as, one or more host sessions, personal computing facilities in combination with a LAN connection, and frequent access to an external information source. The IBM Operating System/2 Extended Edition is designed for these users.

Users whose needs exceed the 640Kb limitation of DOS, but do not require the advanced features of communications and data base of the extended edition may choose to install the IBM Operating System/2 Standard Edition. These environments allow users to run programs larger than 640Kb or to have a number of programs running concurrently, which together exceed 640Kb.

Existing Software Compatibility

The DOS environment of OS/2 provides a level of compatibility between OS/2 and DOS. DOS applications can be run in the DOS environment of OS/2, and the results can be shared with new applications that run only in the OS/2 environment because DOS and OS/2 share the same file system.

However, since the DOS environment does not take full advantage of the facilities of OS/2, such as windowing or multitasking, users should consider migrating applications to the OS/2 environment.

New Applications

OS/2 is an ideal environment in which to develop new applications because it supports the IBM Systems Application Architecture. Because of the standard language support, OS/2 enables organizations to make use of existing programming skills and will allow applications to be migrated to new environments (if the programs adhere to the Common Programming Interface) as required.

Organizations who have a mixture of Intel 8088, 80286, and 80386 based machines can develop applications, through the Family Application Programming Interface facilities, which run in either DOS or OS/2 environments. Family applications, which use of a subset of the OS/2 function may, for example, run in an OS/2 windowing environment and in TopView under DOS.

Support for IBM Operating System/2 Extended Edition

Systems Support

It is recommended that organizations have a systems administration function to provide support for the IBM Operating System/2 Extended Edition. This is especially important in the communications environment where users may need assistance to install and manage the Communications Manager properly.

System administration tasks include:

- Writing installation procedures for software, that includes tailored communications parameters for the specific user environment and procedures for basic problem determination procedures.

- Performing problem determination procedures, which includes identifying the source of a problem and acting as a liaison to the registered Service Coordinator or IBM support services.

- Change management, including testing of any fixes obtained and controlled distribution to users affected and inclusion in future major update for all users.

Communications Manager

To make the transition to the OS/2 communications capability go smoothly, consider the following:

- Look at how the users are now communicating

- What changes might need to be made

- How to best meet the application needs of the users

- How to best plan for providing service to those communications users.

See Appendix C, "Communications Manager Connectivity Support" for supported systems, protocols, and links.

There are some considerations to be made in preparing for the installation of the OS/2 communications capabilities. Although the Communications Manager can probably handle any current user communications, some users will need to perform upgrades to existing systems because more memory may be required. Applications may have to be changed or altered for the OS/2. Host software may have to be upgraded.

It is important to understand the needs of the Communications Manager user.

- Understand what work is currently being performed on personal computers, or IBM Personal System/2

- Where the information is located that needs to be accessed

- Any special applications that may need to be written or updated to meet user requirements.

This knowledge will assist in selecting the best applications, and hardware to address a user's situation; will assist in deciding what arrangements need to be made for them to access information on other hosts or workstations; and will assist in defining application programs to be written to help maximize user productivity.

Programming Interface Information: With the variety of Programming Interfaces available with the Communications Manager, the following information is offered to help decide which interface best suits various types of applications.

The APPC interface supports SNA LU6.2 and should be considered when data resides on a host and the application resides on a workstation. Another possibility is to write an application to the Server/Requester Programming Interface (SRPI).

If a current 3270 application is on a host and the data is on a workstation, consider writing to the IBM PC 3270 PC Entry Emulator High-Level Language Application Program Interface (EEHLLAPI). Applications written to the IBM PC Workstation Program High-Level Language Application Program Interface (HLLAPI) must be recompiled if they contain the 30 verbs used in the EEHLLAPI. If they contain more than the 30 verbs, the application would have to be rewritten.

Depending on the location of information needed by the users, there are other more specific things to consider. For instance, if the information is located on an IBM System/370, ensure that the host contains proper software to accommodate file transfer, applications written to the ECF, and network management. If currently using Control Unit Terminal (CUT) mode for 3270 emulation, consideration should be given to upgrading to DFT to take advantage of the intelligence the PC or Personal Systems offers. If the information needed is on a data servicer, check enrollment procedures, modem requirements, and other information supplied by the data servicer to help with planning.

If dealing with a LAN, some consideration should be given about the timing of upgrading the PC LAN software to OS/2. Programs written to the IBM APPC/PC programming interface will need to be revised to take advantage of the operating system's calls.

Customer Responsibilities: There are several customer planning responsibilities required in the installation and configuration of the Communications Manager. It is recommended that one person be designated to perform these tasks. For purposes of discussion this person will be called a System Administrator.

In most environments it is generally the System Administrator's responsibility to plan the installation; as well as provide guidance to other users on how to install, configure and use the Communications Manager. The System Administrator may need to personalize information for the user. In some cases, the IBM authorized dealer may provide this assistance.

Training Aids

User Familiarization: Introducing OS/2 for the IBM Operating System/2 Standard Editions and the familiarization programs for the IBM Operating System/2 Extended Edition may be used to acquaint users to the facilities of the OS/2. The user familiarization facilities described include the Program Selector, the Communications Manager and the Database Manager.

The product's familiarization program provides both communication and problem determination concepts to the user. Both the familiarization program and an optional customer-created run book can be used as information sources and training tools for the new Communications Manager user.

Online Information: Designed into the Communications and Database Managers are extensive online user aids to assist in performing tasks. These user aids help to reduce the users' need to refer to other sources (such as printed publications) before a task can be completed. The online user aids have been structured to be the principal source for answering user questions. Aids include such things as menus, error messages, and helps.

Classes: To find out what classes are available to learn more about networking and communications, contact the local IBM branch office or dealer.

Database Manager

The IBM Operating System/2 Extended Edition Database Manager introduces IBM data base technology to the personal computer environment. There are no IBM predecessors for this product.

For typical ad hoc use, a prompted query interface is provided by the Query Manager. No previous training is required.

For high level language application development, users should understand relational data base concepts and SQL (refer to *IBM DATA BASE 2 Introduction to SQL*). Additionally, users should understand the OS/2 environment and the supported programming language IBM C/2. (Note: Pascal and COBOL are planned enhancements.)

In all cases, users should verify that the minimum hardware requirements discussed elsewhere have been satisfied.

A variety of Import/Export utilities for the most popular data formats are provided for data migration.

System Installation Considerations

Installation

IBM Operating System/2 (OS/2) is installed by loading the installation diskette. An online menu aid prompts the user for the necessary information. For first-time installations (the fixed disk has not been previously set up), fixed disk preparation is automatic, and directories are created for the system files to be copied. When a system is being updated, a new set of directories is created.

The user will be prompted for specific language requirements and at the end of the install process, the option to verify or change the CONFIG.SYS file created by the install diskette is given.

OS/2 needs more files in the root directory when starting than DOS does (for example, all the basic device drivers must reside there).

System Configuration File

OS/2 uses the CONFIG.SYS file to determine the operating environment. CONFIG.SYS can be a default file created during installation, or it can be a file edited by the user.

The overall operating environment is specified with the following entries in CONFIG.SYS:

PROTECTONLY This option determines if the system will run with the DOS environment or not. If the YES option is selected, existing DOS applications cannot be run. Also, remember that EDLIN only works in the DOS environment.

RMSIZE When the DOS environment is selected by the PROTECTONLY=NO option, RMSIZE is used to specify its size. If RMSIZE is less than 640Kb, the remaining memory up to 640Kb may be used by the OS/2 environment applications.

Note: Be aware that when switching from the DOS environment to the OS/2 environment, the DOS application will stop running.

To control the multitasking capabilities of OS/2, the following options are provided:

THREADS The maximum number of THREADS for the system is specified with this option. The default option is 64, however, the allowable range which may be specified is between 16 and 256.

TIMESLICE The minimum and maximum slice of time allocated to a THREAD may be set by this option. Again the system will provide default values.

PRIORITY The priority of a process may be either absolute or dynamic. The dynamic priority is the default and means that the system recalculates the priority of a process continually.

MAXWAIT This is the number of seconds that elapse before the priority of a process gets increased because of lack of processor service.

An important resource of OS/2 is system memory. To manage memory overcommitment and fragmentation, the following options are provided.

MEMMAN Overcommitment of storage is managed by a swapping mechanism. Swapping is selected by the SWAP keyword (otherwise NOSWAP is selected). In order to eliminate fragmentation, segments may be moved in storage. This option is selected by the MOVE/NOMOVE keywords.

SWAPPATH Gives the path to the swap area on disk. If not specified, the root directory will be used. In a time critical system, do not allow swapping nor memory compaction. See "Performance Characteristics" section.

In order to use the dynamic linking feature, path information must be provided to enable the system to find the dynamic link modules at load or run time.

LIBPATH Tells the OS/2 where to find the dynamic link modules. If omitted, the system will search the current root directory for the dynamic link modules.

Dynamic linking will normally conserve memory. As an example, error routines would only be loaded as required. Common routines should be made reentrant so that just one copy could be used by many processes.

Trace functions are provided (in the OS/2 environment **only**) to simplify debugging.

TRACE   Use the TRACE command to actually start and stop the trace function.

TRACEBUF Gives you the size of the associated wrap around buffer in increments of 1Kb (up to 64Kb). The default is 4Kb.

TRACEFMT Use the TRACEFMT command to list the trace data.

National Language Support functions are expanded in OS/2 to include loading of code pages in devices supporting this feature.

CODEPAGE Is specified in order to select code pages to be loaded into the loadable character generator of your display adapter (where applicable) or printer (where applicable). An application will now be able to switch between the code pages selected for loading. The command CHCP may also be used to switch between code pages.

DEVINFO   Is used to select the devices for code page loading.

The OS/2 allows one or more processes to be run at initialization time.

RUN   Processes specified in the RUN option will be invoked during system initialization. Certain restrictions apply to the processes invoked by RUN. These processes will always run in the background, and consequently are not able to communicate with the screen or keyboard.

              Examples of the processes that could be invoked at this point are the print spool program or the KEYB XX command (if not using the US keyboard).

IOPL   Normally an application is not allowed to use the I/O instructions of the processor. Certain programs have a requirement to issue I/O instructions. This is allowed by specifying IOPL in the CONFIG.SYS file.

Startup Execution

The means of starting a process automatically during the OS/2 initialization, in addition to using the RUN parameter in CONFIG.SYS, is to specify a batch file called STARTUP.CMD (batch files in the OS/2 environment have a .CMD extension). This is executed when OS/2 is started.

Many processes can be started from STARTUP.CMD, allowing the Communications and Database Managers to start automatically, for example.

If no STARTUP.CMD is provided, the Program Selector is presented. This is a panel listing the programs to be started. The OS/2 command prompt and DOS command prompt are on this list (if the DOS environment is specified). When the OS/2 command prompt is selected, an OS/2 environment command line will be displayed. When the DOS command prompt is selected, an AUTOEXEC.BAT (if present) will be executed, otherwise the command line of the DOS environment will be displayed.

Additional Planning Considerations

Intel 80386 Considerations

Several considerations should be evaluated to position an application to use the Intel 80386.

- Current Intel 80286 applications can run unchanged on the Intel 80386, but they use 16-bit interfaces. They cannot take advantage of the 32-bit architecture.

- Applications should be written to high-level language interface. This facilitates converting the applications (when compilers are available) to take advantage of the Intel 80386 capabilities (32-bit addressing, for example).

- Applications written in an assembly language require modification and careful redesign to work correctly in a mixed (16-bit and 32-bit) environment. Care must be taken in the use of the stack to assure that 16-bit programs can successfully call and return from 32-bit programs and vice versa. A knowledge of the Intel 80386 architecture by the application developer is a requirement when designing assembler applications for a mixed environment.

Planned Enhancements

Standard Edition

To help customers with their future planning, the following enhancements will be made to IBM Operating System/2 (OS/2) Standard Edition:

- Support of fixed disk partitions greater than 32Mb

- Application development facilities for the Dialog Manager interface.

Communications Manager

Planned enhancements to the OS/2 Communications Manager include SNA LAN gateway support, additional support for ECF enhancements, IBM 5250 workstation feature, X.25 feature support, and a high-level language 3270 program interface. Applications written to the Entry Emulator High Level Language Application Program Interface (EEHLLAPI) of the IBM PC 3270 Emulation Program, Entry Levels 1.1 and 1.2 can be recompiled to work on the IBM Operating System/2 Extended Edition when using IBM Macro Assembler/2, IBM Pascal Compiler/2 or IBM C/2.

Database Manager

As a planned enhancement to the Database Manager, IBM will provide Remote Data Services and LAN support. This means data base support for the IBM Personal Computer or IBM Personal System/2 on an IBM Token-Ring or IBM PC Network with no additional user programming. Multiple workstations will be allowed to access a common data base. A single workstation will be allowed to access a data base located elsewhere on a LAN.

Other planned enhancements include COBOL and Pascal precompiler support for SQL statements embedded in IBM COBOL/2 or IBM Pascal Compiler/2 application programs. Also, Import Utility support of non delimited ASCII files to assist in importing data from other applications.

In summary, IBM Operating System/2 Extended Edition provides a *Data Base Management System (DBMS)* for IBM Personal Computer users. The full power of a relational data base is implemented which is consistent with IBM host relational data base products DB2 and SQL/DS. The Database Manager provides an extensive subset of SQL which was announced as part of the Common Programming Interface of the IBM Systems Application Architecture. The query and report facilities are an extensive subset of those in the IBM Query Management Facility (QMF) on IBM host systems. LAN support enhancements will provide multiple-user/LAN data base access with no additional user programming.

Packaging and Release

IBM Operating System/2 will be distributed on 3.5-inch high-capacity (1.44Mb) diskettes and 5.25-inch high-capacity (1.2Mb) diskettes in separate packages.

Standard Edition, Version 1.0

IBM Operating System/2 Standard Edition, Version 1.0 contains the basic multitasking operating system supporting large memory applications. General availability is announced for first quarter 1988.

IBM Operating System/2 Standard Edition, Version 1.0 includes a User's Guide and a User's Reference. A Programmer Toolkit is available for separate purchase, and includes the IBM Operating System/2 Programmer's Guide. An IBM Operating System/2 Technical Reference is available for separate purchase.

Standard Edition, Version 1.1

IBM Operating System/2 Standard Edition, Version 1.1 contains the windowing system and the enhanced user interface. General availability will be announced in the fourth quarter 1987.

IBM Operating System/2 Standard Edition, Version 1.1 includes a User's Guide. Version 1.1 User's Reference and Technical Reference will be available for separate purchase. IBM Operating System/2 Programmer Toolkit, Version 1.1 will be available for separate purchase and will be enhanced to allow applications to be developed to run under the windowing system. Publications relating to windowing and graphics will be supplied with the Toolkit.

Extended Edition, Version 1.1

IBM Operating System/2 Extended Edition enhances IBM Operating System/2 Standard Edition with a Communications Manager and a Database Manager. Availability will be announced in the fourth quarter 1987.

Appendix A. National Languages Support

The IBM Operating System/2 User's Guide and User's Reference as well as the screens and messages, will be available in these languages:

Canadian French (subsystems only)

Danish

Dutch

English (United States and United Kingdom)

Finnish

French

German

Italian

Norwegian

Portuguese

Spanish

Swedish

Keyboards Supported

Language	Parameter	PC	3270 Emulation	3101 Emulation
Belgian	BE	X	X	
Canadian French	CF	X	X	X
Danish	DK	X	X	
Dutch	NL	X	X	
Finnish	SU	X	X	
French	FR	X	X	X
German	GR	X	X	X
Italian	IT	X	X	
Latin American Spanish	LA	X	X	
Norwegian	NO	X	X	
Portuguese	PO	X	X	
Spanish	SP	X	X	
Swedish	SV	X	X	
Swiss French	SF	X	X	

Language	Parameter	PC	3270 Emulation	3101 Emulation
Swiss German	SG	X	X	
United Kingdom English	UK	X	X	X
United States English	US	X	X	X

Code Pages Supported: In addition to the 437 PC ASCII code page, the following code pages are supported.

850 Multilingual

860 Portuguese

863 Canadian French

865 Danish/Norwegian

Name the code pages used (two maximum) in the CODEPAGE option of CONFIG.SYS, and in the DEVINFO option specify the device(s) supporting loadable code pages.

Appendix B. Applications Support

The following products operate in the OS/2 environment of OS/2 on the IBM Personal System/2, the IBM Personal Computer AT, and the IBM PC XT, Model 286. These products can be used in the development of applications for the full functions of the OS/2.

Product	Version	3.5-Inch P/N	5.25-Inch P/N	
IBM BASIC Compiler/2	1.00	6280179	6280179	See Note
IBM C/2	1.00	6280187	6280187	See Note
IBM COBOL/2	1.00	6280207	6280207	See Note
IBM FORTRAN/2	1.00	6280185	6280185	See Note
IBM Macro Assembler/2	1.00	6280181	6280181	See Note
Operating System/2 Programmer Toolkit	1.00	6280200	6280200	
Operating System/2 Graphics Development Toolkit	1.00	6280202	6280202	
IBM Pascal Compiler/2	1.00	6280183	6280183	See Note

Note: This product also runs in the DOS environment of OS/2

An OS/2 application, Displaywrite 4.2 will be available at release of version 1.0 of OS/2. It will be available on both a 3.5-inch diskette (P/N 75X1121) and a 5.25-inch diskette (P/N 75X1122).

IBM Software

IBM intends to test the following licensed software products in the DOS environment of OS/2. A complete list of tested software will be published upon availability of the OS/2.

Applications which may not run in compatibility mode include time-dependent programs, such as communications and real-time applications, hardware-specific routines such as device drivers and network-dependent applications.

Product	Version	3.5-inch P/N	5.25-inch P/N
PROGRAMMER TOOLS AND LANGUAGES			
BASIC Compiler	2.00	6280078	6024216
BASIC Interpreter	3.31	6280060	6280060
C Compiler	1.00	6280081	6280072
IBM COBOL	2.00	6280177	6280177
EZ-RUN (Cross System Product/Application Execution)	1.00		6317010
EZ-PREP (Cross System Product/Application Generation)	1.00		6317011
FORTRAN Compiler	2.00		6024127
Graphics Development Toolkit	1.20	6280203	6280203
Interative System Productivity Facility for the IBM Personal Computer (EZ-VU II Runtime Facility	2.00		6317025
Interactive System Productivity Facility/Program Development Facility Editor for the IBM Personal Computer (EZ-VU Editor)	1.00		6466974
Interactive System Productivity Facility for the IBM Personal Computer (EX-VU II Development Facility)	2.00		6317026

Product	Version	3.5-inch P/N	5.25-inch P/N
Macro Assembler	2.00	6280077	6024193
Pascal Compiler	2.02	6280166	6280166
Professional FORTRAN	1.30	6280127	6280127
BUSINESS/PRODUCTIVITY APPLICATIONS			
DisplayWrite 4	1.00	74X9913	74X9904
Personal Editor II	1.01	6276701	
Storyboard Plus	1.00	6024401	6024401
Word Proof II	1.01	6276700	
Assistant Series			
DisplayWrite Assistant	1.00	59X9958	59X9958
Document Retrieval Assistant	1.00		6024089
Drawing Assistant	1.00		6024089
Filing Assistant	2.00	6024457	6024457
Graphing Assistant	2.00	6024458	6024458
Planning Assistant	2.00	6024461	6024461
Project Assistant	1.00	6024462	6024462
Reporting Assistant	2.00	6024459	6024459
Writing Assistant	2.00	6024460	6024460
Accounting Assistant Series			
Accounts Payable Edition	1.00	6467004	6317050
Accounts Receivable & Billing Edition	1.00	6467005	6317051
General Accounting Edition	1.00	6467003	6317049
Inventory Control & Purchasing Edition	1.00	6467007	6317053
Job Cost Edition	1.00	6467008	6317054
Payroll Edition	1.00	6467006	6317052
Business Adviser			
Accounts Payable Edition	1.20	6476056	6466989
Accounts Receivable Edition	1.20	6476057	6466990
General Accounting Edition	1.20	6476055	6466988

Product	Version	3.5-inch P/N	5.25-inch P/N
Information Management Edition	1.20	6476069	6466995
Inventory Control Edition	1.20	6476067	6466993
Order Entry Edition	1.20	6476068	6466994
Payroll Edition	1.20	6476058	6466991
Personal Decision Series			
Data Edition	2.00	6476085	6476060
English Access Edition	1.00	6476079	6476065
Plans+ Edition	2.00	6476076	6476062
Reports+ Edition	2.00	6476075	6476061
OTHER APPLICATIONS			
Doctor's Office Manager II	1.00		6467035
Topview	1.12	6024475	6024475

Vendor Logo Software

The following independent software vendors have informed IBM that they intend to test the listed products in the DOS environment of the OS/2. IBM does not warrant that this work will be performed.

Note that these programs have not been tested to date and IBM makes no guarantee that the programs will work when tested. Applications which may not run in compatibility mode include time-dependent programs, such as communications and real-time applications, hardware specific routines such as device drivers and network-dependent applications.

Software Publisher	Product
Ashton-Tate	CHART-MASTER dBase III Plus Framework II MultiMate Advantage
BORLAND INTERNATIONAL, INC.	Reflex SideKick Turbo Lightning Turbo Pascal
Computer Associates International, Inc.	SuperCalc 4 SuperProject Plus EasyBusiness Systems
Lattice, Inc.	Lattice C Compiler Unicalc Spreadsheet
Living Videotext, Inc.	Ready! ThinkTank
MicroPro International Corporation	Easy Extra WordStar Professional WordStar 2000 Plus
Microrim Inc.	R:BASE 5000 R:BASE CLOUT R:BASE Extended ReportWriter R:BASE System V
Software Publishing Corporation	Harvard Series pfs:First Choice pfs:Professional Series
WordPerfect Corporation	WordPerfect WordPerfect Library WordPerfect Math Plan
Z-SOFT Corporation	PC Paintbrush Publisher's Paintbrush

Appendix C. Communications Manager Connectivity Support

Supported Systems	Interface or Emulation	Protocol	File Transfer	Link[1]
IBM System/370 Architecture including 9370	APPC	LU6.2	—	SDLC (3720, 3725, 3705, 3726, and 9370 Integrated Controller)
				TOKEN-RING (3270, 3725, 3726, and 9370 Integrated Controller)
				TOKEN-RING using 3174's 3270 Gateway Feature (#3025) for PU2.0
	SRPI	LU2	—	DFT via 3174/3274 (Upstream to SDLC, BSC, or Channel) and 9370 Workstation controller
	3270	LU2	3270-PC File Transfer Program	
				SDLC (3720,3725,3705,3726, and 9370 Integrated Controller)
				TOKEN-RING (3720, 3725, 3726, and 9370 Integrated Controller)
				TOKEN-RING using 3174's, 3270 Gateway Feature (#3025) for PU2.0
	3101, VT100[2]	—	3270-PC File Transfer Program	ASYNC[2]
IBM Personal System/2 and IBM PC	APPC	LU6.2	—	SDLC TOKEN-RING PC NETWORK
	—	—	XMODEM, PACING+	ASYNC
IBM System/36	APPC	LU6.2	—	SDLC, TOKEN-RING

Supported Systems	Interface or Emulation	Protocol	File Transfer	Link[1]
IBM System/38	APPC	LU6.2	—	SDLC
IBM Series/1	APPC	LU6.2	—	SDLC
	3101	—	—	ASYNC
IBM System/88	APPC	LU6.2	—	SDLC
IBM RT/PC	APPC	LU6.2	—	SDLC
	VT100	—	XMODEM	ASYNC
OTHER HOSTS[3]	VT100	—	XMODEM, PACING+	ASYNC
	3101*	—	XMODEM, PACING+	ASYNC

Notes:

* Character mode.

+ Sending an ASCII text file to another system.

1. OS/2 Communications Manager will support combinations of these links subject to the limitations imposed by installed adapters, memory size, and processor capacity. All supported SNA links can be shared by applications which may use up to five 3270 display sessions per workstation over SDLC, IBM Token-Ring Network, and DFT links. A maximum of 255 concurrent SNA LU6.2 sessions are supported over remote SDLC or local IBM Token-Ring LAN links. Asynchronous links are serially usable.

2. Asynchronous users requiring SNA support must use a protocol converter on the link.

3. Appropriately programmed.

Appendix D. Hardware Support

The minimum hardware configuration for IBM Operating System/2 is:

- IBM Personal Computer AT, IBM Personal Computer XT Model 286, IBM Personal System/2 Models 50, 60, or 80 with a recommended minimum memory as follows:
  - 1.5Mb for OS/2 Standard Edition with the OS/2 environment only
  - 2.0Mb for OS/2 Standard Edition with DOS environment
  - 3.0Mb for OS/2 Extended Edition
- One diskette drive (5.25-inch or 3.5-inch, high capacity) described below
- One fixed disk drive described below

  Note: Users needing large data bases, large numbers of programs and files, or execution of several concurrent applications (requires segment swap areas) should assure they have the capability to expand their hardfile above 20Mb.

- Keyboard
- Display and associated display adapter described below

Devices Supported by the Base IBM Operating System:

- Diskette Drives
  - IBM 3.5-inch diskette drive (720Kb)
  - IBM 3.5-inch high capacity diskette drive (1.44Mb)
  - IBM 5.25-inch diskette drive (360Kb)
  - IBM 5.25-inch high-capacity diskette drive (1.2Mb)
  - IBM 4865 Model 2 External 3.5-inch diskette drive (720Kb)
  - IBM Personal System/2 5.25-inch External Diskette Drive (360Kb)
- Fixed Disks
  - IBM 20Mb Fixed Disk Drive
  - IBM 30Mb Fixed Disk Drive
  - IBM Personal System/2 44Mb Fixed Disk Drive
  - IBM Personal System/2 70Mb Fixed Disk Drive
  - IBM Personal System/2 115MB Fixed Disk Drive

    Note: The 44Mb, 70Mb, and 115Mb fixed disks are supported as multiple logical drives, each having a maximum size of 32Mb.

- One Adapter/Display combination below:
  - IBM Color/Graphics Monitor Adapter with IBM Color Display (5143)
  - IBM Enhanced Graphics Adapter with one of the following displays:
    - IBM Enhanced Color Display (5154)
    - IBM Color Display (5153)
  - IBM Personal System/2 Display Adapter (FC #4050) with one of the following displays:

- — IBM Personal System/2 Monochrome Display (8503)

- — IBM Personal System/2 Color Display (8512)

- — IBM Personal System/2 Color Display (8513)

- — IBM Personal System/2 Color Display (8514)

- — IBM Personal System/2 system unit (model 50, 60, or 80) with one of the following displays:

  - — IBM Personal System/2 Monochrome Display (8503)

  - — IBM Personal System/2 Color Display (8512)

  - — IBM Personal System/2 Color Display (8513)

  - — IBM Personal System/2 Color Display (8514)

- — IBM Personal System/2 Display Adapter 8514/A (FC #4054) with one of the following displays:

  - — IBM Personal System/2 Monochrome Display (8503)

  - — IBM Personal System/2 Color Display (8512)

  - — IBM Personal System/2 Color Display (8513)

  - — IBM Personal System/2 Color Display (8514)

- Printers

  - — IBM 4201 Proprinter[TM1], Model 1

  - — IBM 4201 Proprinter II[TM1]

  - — IBM 4202 Proprinter XL, Model 1

  - — IBM 4207 Proprinter X24

  - — IBM 4208 Proprinter XL24

  - — IBM 5152 Graphics Printer Model 2

  - — IBM 5182 Color Printer Model 1

  - — IBM 5201 Quietwriter®[11] Model 1 and Model 2

  - — IBM 5202 Quietwriter®[11] III

  - — IBM 5216 Wheelprinter, Model 1

  - — IBM 5223 Wheelprinter E, Model 1

- Other Input Devices

  - — Keyboard

  - — IBM Personal System/2 Mouse

  - — Serial Pointing Device

    - — Microsoft[12] Mouse for IBM Personal Computers, 100ppi

    - — Microsoft[12] Mouse for IBM Personal Computers, 200ppi

    - — PC Mouse[13], 100ppi

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[11] Registered trademark of International Business Machines Corporation

[12] Registered trademark of Microsoft Corporation

[13] Trademark of Metagraphics/Mouse Systems

- — Visi On[14] Mouse, 100ppi
- — Parallel Pointing Device for IBM Personal Computer AT and IBM Personal Computer XT Model 286
  - — Microsoft[12] Mouse for IBM Personal Computers, 100ppi
  - — Microsoft[12] Mouse for IBM Personal Computers, 200ppi
- — InPort Microsoft[12] Mouse for IBM Personal Computer AT and XT/286, 200ppi

- Other
  - — IBM Personal Computer AT Serial/Parallel Adapter Card (#0215, #3395, #3400)
  - — IBM Personal Computer AT Memory Expansion Adapter (#0209, #3343/3397, #3343/3339, #3395/3397/3402, #3400/3402)
  - — IBM Personal System/2 Models 50 and 60 (#3006/3012, #3920)
  - — IBM Personal System/2 Model 80 (#3009, #3019/3064)
  - — IBM Personal System/2 Dual Async Adapter/A (#3033)
  - — IBM Personal System/2 Multiprotocol Adapter/A (#3042) in asynchronous mode

- Plotter
  - — IBM 6180 Plotter
  - — IBM 6184 Plotter
  - — IBM 6186 Plotter
  - — IBM 7371 Plotter
  - — IBM 7372 Plotter
  - — IBM 7374 Plotter
  - — IBM 7375 Plotter

- Math Coprocessor (Intel 80287)

- Math Coprocessor (Intel 80387) as an Intel 80287

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[14] Trademark of VisiCorp

Glossary

A

ACDI. Asynchronous Communications Device Interface

alert. An error message sent to the system control point at the host system

ANSI (American National Standards Institute). An organization consisting of producers, consumers, and general interest groups, that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States.

APA (All points addressable). In computer graphics, pertaining to the ability to address and display or not display each picture element on a display surface.

API. (1) Application program interface. (2) Application programming interface.

APPC. Advanced program-to-program communication

application. The use to which an information processing system is put, for example, a payroll application, an airline reservation application, a network application.

application program. (1) A program written for or by a user that applies to the user's work, such as a program that does inventory control or payroll. (2) A program used to connect and communicate with stations in a network, enabling users to perform application-oriented activities.

ASCII. American National Standard Code for Information Interchange. The standard code, using a coded character set consisting of 7-bit coded characters (8-bits including parity check), used for information interchange among data processing systems, data communication systems, and associated equipment

ASYNC (asynchronous). Without regular time relationship; unexpected or unpredictable with respect to the execution of program instructions.

average access time. The average time between the instant of request and the delivery from a storage device.

B

backup. (1) Pertaining to a system, device, file, or facility that can be used in the event of a malfunction or loss of data. (2) To copy information, usually onto diskette or tape, for safekeeping.

buffer. (1) A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events when transferring data from one device to another. (2) A portion of storage used to hold input or output data temporarily.

C

character set. A defined set of alphanumeric characters and symbols.

child process. (1) A process that is created by another process. (2) A dependent process. Contrast with parent process.

clipboard function. Function provided to enable the user or application to extract data from one window to another or from one application to another.

CMD.EXE. The program that interprets and runs OS/2 commands.

code page. A matrix that assigns graphic and control characters to specific hexadecimal values or code points.

COMMAND.COM. The program that interprets and runs DOS commands.

command processor. In OS/2 a program (COMMAND.COM or CMD.EXE) that interprets and runs commands.

command prompt. A displayed symbol, such C>, that requests input from the user.

component. Hardware or software that is part of a functional unit.

coprocessor. A microprocessor that extends the address range of the processor in the system unit or adds specialized instructions to handle a particular category of operations; for example, an I/O coprocessor, a math coprocessor, a networking coprocessor.

CPI. Common Programming Interface

D

data base. (1) A set of data, part or the whole of another set of data, that consists of at least one file, and that is sufficient for a given purpose or for a given data processing system. (2) A collection of data fundamental to a system.

data stream. All data transmitted through a data channel in a single read or write operation.

DBCS. Double Byte Character String

DB2. IBM Data Base 2

DFT. Distributed Function Terminals

DOS. IBM Personal Computer Disk Operating System

dynamic linking. The delayed linking of a program to a routine so that the routine is not linked until load time or run time.

dynamic (priority). Pertaining to a priority (of a process) that is varied by the operating system. Contrast with absolute (priority).

dynamic link library. A module that is linked at load time or run time.

E

ECF. Enhanced Connectivity Facilities

emulation. The use of programming techniques and special machine features to permit a computing system to execute programs written for another system.

EEHLLAPI. Entry Emulator High-Level Language Application Program Interface

error log. A data set or file in a product or system where error information is stored for later access.

F

flag. A character that signals the occurrence of some condition, such as the end of a word.

H

HLLAPI. High-Level Language Application Program Interface

I

I/O. Input/Output.

IBM PC Network. A low-cost broadband network that allows attached IBM personal computers to communicate and share resources.

IBM Token-Ring Network. A high speed, star-wired local area network to which a variety of IBM products can be connected.

interactive. Pertaining to a program or system that alternately accepts input and then responds.

interactive session. That group of processes (or tasks) that currently own the keyboard, mouse, display, or other interactive input device.

interface. Hardware, software, or both, that links systems, programs, or devices.

Interprocess Communication. The exchange of information (such as, by means of messages) between processes or threads.

K

Kb. Kilobyte; 1024 bytes

L

LAN. Local Area Network

LU (Logical Unit). communication protocol

M

Mb. Megabyte; 1,048,576 bytes.

memory. Program-addressable storage from which instructions and other data can be loaded for subsequent execution or processing.

menu. A displayed list of items from which a user can make a selection.

multiprogramming. The concurrent processing of two or more programs by a computer.

multitasking. The virtually simultaneous processing of two or more tasks by the operating system.

MVS. Multiple Virtual Storage

multiuser. Two or more people who use the services of a processor within a given period of time; usage is normally serial unless otherwise specified.

MVS-CICS. Multiple Virtual Storage-Customer Information Control System

MVS/TSO. Multiple Virtual Storage/Time-Sharing Option

N

national language character set. The character set that contains the alphanumeric and special symbols used in a particular language.

NETBIOS. An operating system interface for application programs used on IBM personal computers that are attached to the IBM Token-Ring Network.

O

operating system files. Files (such as IBMBIO.COM and IBMDOS.COM) that contain the operating system.

P

pacing. A technique by which a receiving station controls the rate of transmission of a sending station to prevent overrun.

parameter. Data passed between programs or procedures.

parent process. (1) A process that creates other process. (2) An independent process. Contrast with child process.

partition. An area of storage on a fixed disk that contains a particular operating system or logical drives where data and programs can be stored.

password. In computer security, a string of characters known to the computer system and a user, who must specify it to gain full or limited access to a system and to the data stored within it.

pipe. To start execution of an instruction sequence before the previous instruction sequence in completed to increase processing speed.

problem determination. These functions include tracing of programming interfaces and data units to file, storage, or printer; displaying and printing of all selected error logs from file; system dumping; and displaying of all or selected messages from file or storage.

procedure. A set of related control statements that cause one or more programs to be performed.

process. A sequence of operations that produces a specific result.

processor. In a computer, a functional unit that interprets and processes instructions.

PROFS. Professional Office System

protocol. A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication.

Q

QMF. Query Manager Facility

query. In interactive systems, an operation at a terminal that elicits a response from the system.

queue. A line or list of items waiting to be processed; for example, work to be performed or messages to be displayed.

R

RAM. Random access memory.

reentrant. The attribute of a program or routine that allows the same copy of a program or routine to be used concurrently by two or more tasks.

ROM BIOS (Read-Only Memory Basic Input/Output System). In an IBM personal computer, microcode in read-only memory that controls basic input/output operations such as interactions with diskette drives, fixed disk drives and the keyboard.

S

SDLC. Synchronous Data Link Control

segment. A variable-length area of contiguous storage addresses not exceeding 64Kb.

semaphore. An indicator used to control access to a file; for example, in a multi-user applications, a flag that prevents simultaneous access to a file.

session. In this book, this term refers to that group of process (or tasks) associated with an application.

SNA. Systems Network Architecture

SQL. Structured Query Language

SRPI. Server Requester Programming Interface

storage compaction. Relocating allocated storage segments into contiguous locations in order to place all free storage in one large block

storage dump. A copy of the contents of a storage or a part of a storage at a specified point in time, that is recorded on an external medium such as a disk.

suspend. An action that causes an active program to become temporarily inactive. In effect, the suspended program is waiting for the user to reactivate it.

swap file. A file that contains segments of a program or data temporarily moved out of main storage.

swapping. A process that moves segments between system storage and extended storage.

system configuration. A process that specifies the devices and programs that form a particular data processing system.

system dump. A dump of all active programs and their associated data after an error stops the system.

T

task. (1) A basic unit of work to be accomplished by the computer. (2) A program running in the computer.

thread. The smallest unit of processing with a process.

time slice. A designated interval of processing time allocated for doing a task.

U

utility. The capability of a system, program, or device to perform the functions for which it is designed.

V

VM/CMS. Virtual Machine/Conversational Monitor System

VSE-CICS. Virtual Storage Extended-Customer Information Control System

W

windowing. Dividing a display screen into distinct areas in which different display images can be viewed at the same time.

X

X.25 feature. A feature that allows a system to be connected to an X.25 network.

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